Neural Smithing

Supervised Learning in Feedforward Artificial Neural Networks

Russell D. Reed and Robert J. Marks, II

A Bradford Book
The MIT Press
Cambridge, Massachusetts
London, England

1999

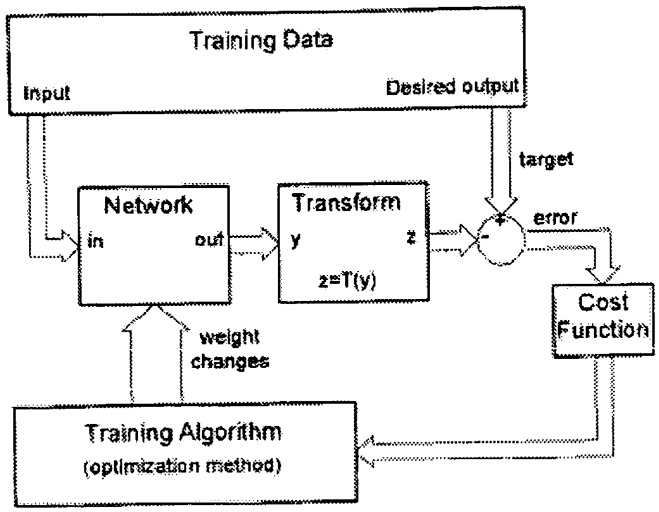

Figure 2.4
In supervised learning with a distal teacher the network output drives another system, *T*, which produces the final output. This makes the teacher's job easier because targets can be specified at a higher, less detailed, level. When *T* is a known function, the low-level signals needed for network training can be derived from the high-level errors.

ment learning, but less informative than in regular supervised learning. As in reinforcement learning, the network outputs act as inputs to another system, *T*, which transforms the network outputs into the final output. When *T* is well-defined or can be accurately modeled, errors in the overall system-output can be translated backwards to the low level network-output error signals needed for network training. When the overall targets can be specified simply, the teacher's job is simpler.

Using the task of throwing a ball as an analogy, the network outputs are the numerous coordinated muscular actions needed to toss the ball and *T* is the physics that transform these actions into a result. If the overall goal is to land a basketball in a hoop, the sight of it bouncing off the rim may be a high-level error signal. No coach can tell you exactly when and how to move each individual muscle, but they can provide high-level suggesti ons in terms you already know how to implement, for example, "put more spin on it." Knowledge of the situation then allows you to translate the high-level suggestion back to individual low-level actions.

Simulation results for a simple robot arm controller are described in [200, 201, 199]. Given inputs representing a position (x, y), the desired network outputs are the joint angles that put the manipulator in this position (figure 2.5). Physical properties of the arm determine the relationship *T* between the network outputs (joint angle commands) and the

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7	185	((neural adj net$5) near30 (feedforward or feed adj forward)) and (resist$5 or pathogen$3 or drug or mutation)	USPAT; US-PGPUB	2002/01/23 09:29
10	194	(neural and net$5) and (feedforward or feed adj forward)	EPO; JPO; DERWENT; IBM_TDB	2002/01/23 09:44
15	104	((neural and net$5) and (feedforward or feed adj forward)) not us.pc.	EPO; JPO; DERWENT; IBM_TDB	2002/01/23 09:44

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